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EXAMINER

CONNELLY CUSHWA, MICHELLE R

ART UNIT PAPER NUMBER

2874

DATE MAILED: 06/10/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Applicati n N .

09/918,398

Applicant(s)

MALSUURA ET AL.

Examiner

Michelle R. Connelly-Cushwa

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 24 October 2003 and 11 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-23 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 and 18-23 is/are rejected.
- 7) ☒ Claim(s) 17 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 July 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Amendment

Applicant's Response filed October 24, 2003 has been fully considered and entered.

Applicant's Amendment filed February 11, 2004 has been fully considered and entered.

In view of the Applicant's priority claim to provisional Application No. 60/222,481, filed July 31, 2000, the prior art rejections to claims 1-23 over Cotteverte et al. (US 2002/0048422 A1) have been withdrawn.

It is noted by the Examiner that Applicant did not address the objection to claim 17 set forth in the Office action mailed July 9, 2003. The objection is repeated below and a complete response to the present Office action must address the objection.

Claim Objections

Claim 17 is objected to because of the following informalities: the claim contains the limitation "and includes compensation in part or in whole of said device, and includes compensation in part or in whole of the physical geometry of said photonic crystal" in lines 3-5 of claim 17. Although, after reading the specification (see page 9, line 31, through page 10, line 1 of the present application), it is understood that the compensation is for imperfections in the photonic crystal structure, the language of the claim must define what the compensation is for to be clear and concise.

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The Examiner suggests amending claim 17 by inserting --for imperfections in the photonic crystal structure-- after "compensation" in line 3 of claim 17, and by inserting --for imperfections--after "compensation" in line 4 of claim 17 to overcome this objection.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 10 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 10; the claim recites the limitation "the non-linear response" in lines 2-3 of the claim. There is insufficient antecedent basis for this limitation in the claim. Claims 1-5, which claim 10 alternatively depends from, do not define a non-linear response.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 2, 4, 5, 8/1, 8/2, 8/4, 8/5, 9/1, 9/2, 9/4, 9/5, 13/1, 13/2, 13/4, 13/5, 14/1, 14/2, 14/4, 14/5, 15/1, 15/2, 15/4, 15/5, 19, 20, 22 and 23 are rejected under 35 U.S.C. 102(b) as being anticipated by Milstein et al. (US 5,385,114).

Regarding claims 1 and 19; Milstein et al. discloses a photonic crystal for use in a photonic device, the photonic crystal having configuring means for effecting a change to the physical geometry in at least one region of the photonic crystal such that the propagation of light therethrough or the confinement of light therein is thereby altered (see column 12, line 60, through column 13, line 45).

Regarding claims 2, 4, 5, 20, 22 and 23; Milstein et al. discloses that the configuring means may be an electrostrictive or magnetostrictive component of the photonic crystal (see column 13, lines 29-35). Electrostrictive and magnetostrictive components are actuation devices.

Regarding claims 8/1, 8/2, 8/4, 8/5, 9/1, 9/2, 9/4, 9/5, 13/1, 13/2, 13/4, 13/5, 14/1, 14/2, 14/4, 14/5, 15/1, 15/2, 15/4 and 15/5; the configuring means provides:

- at least one change in the respective frequency of one or more beams of light propagating through the device;
- at least one change in the respective frequency of one or more modes of light confined in the device;
- at least one change in each of the respective spatio-temporal electric and magnetic field intensities associated with one or more beams of light propagating through the device or confined therein;
- one or more changes in respective direction, frequency, electric and magnetic field intensity, or combinations thereof, associated with one or more beams of light propagating through the device as a function of time; and

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- one or more changes in respective electromagnetic field pattern, frequency, electric and magnetic field intensity, or combinations thereof, associated with one or more modes of light confined within the device as a function of time (see column 13, lines 14-45, and claim 1 of Milstein et al.).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 3, 8/3, 9/3, 13/3, 14/3, 15/3 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milstein et al. (US 5,385,114).

Regarding claims 3 and 21; Milstein et al. discloses all of the limitations of claim 3 and 21 as applied above, except for specifically stating that configuring means includes a piezoelectric component. In column 13, lines 14-29, Milstein et al. teaches that the configuring means may include a means of controlling the mechanical dimensions of the photonic band gap material by applying mechanical force or pressure to the material to modify the dimensions. Milstein et al., however, does not disclose that a particular means for applying the mechanical force and/or pressure must be used in the invention, thereby suggesting a lack of criticality in the particular means used to do so. Piezoelectric components/elements are commonly used to apply mechanical force or pressure to materials in the art. Therefore, one of ordinary skill in the art would have

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found it obvious to incorporate a piezoelectric component/element in the invention of Milstein et al. to apply mechanical force and/or pressure to the photonic band gap material, since it appears the invention would perform equally well regardless of the specific means used to apply the mechanical force and/or pressure, since piezoelectric components/elements are known and used in the art to apply mechanical force and/or pressure to materials, and since Applicant has not disclosed that the use of a piezoelectric component/element solves any stated problem or is for any particular purpose.

Regarding claims 8/3, 9/3, 13/3, 14/3 and 15/3; the configuring means provides:

- at least one change in the respective frequency of one or more beams of light propagating through the device;
- at least one change in the respective frequency of one or more modes of light confined in the device;
- at least one change in each of the respective spatio-temporal electric and magnetic field intensities associated with one or more beams of light propagating through the device or confined therein;
- one or more changes in respective direction, frequency, electric and magnetic field intensity, or combinations thereof, associated with one or more beams of light propagating through the device as a function of time; and
- one or more changes in respective electromagnetic field pattern, frequency, electric and magnetic field intensity, or combinations

thereof, associated with one or more modes of light confined within the device as a function of time (see column 13, lines 14-45, and claim 1 of Milstein et al.).

Claims 6/1-6/5 and 11/1-11/5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milstein et al. (US 5,385,114) in view of Joannopoulos ("The Almost Magical World of Photonic Crystals").

Regarding claims 6/1-6/5; Milstein et al. teaches all of the limitations of claims 6/1-6/5 as applied above, except for specifically stating that the at least one change is in the respect direction of propagation of one or more beams of light of fixed frequency.

Joannopoulos teaches that photonic crystals are comprised of material that can control the properties of electromagnetic waves, that line-defects in photonic crystals act like waveguides, which control the direction of the propagation of light, and that photonic crystals may be used to guide light around sharp corners (see page 232). Therefore, one of ordinary skill in the art would have recognized that the direction of the propagation of a beam of light of fixed frequency could be controlled by creating line-defects in a photonic crystal to form a waveguide to direct the light as taught by Joannopoulos.

Thus, one of ordinary skill in the art would have found it obvious to use the configuring means disclosed by Milstein et al. to create a line-defect in a photonic crystal device to form a waveguide that would change the direction of propagation of one or more beams of light of fixed frequency.

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Regarding claims 11/1-11/5; the proposed combination of Milstein et al. and Joannopoulos teaches all of the limitations of claims 11/1-11/5 as applied to claims 6/1-6/5 and 8/1-8/5 above.

Claims 7/1-7/5, 12/1-12/5 and 16/1-16/5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milstein et al. (US 5,385,114) in view of Scherer et al. (US 6,711,200 B1).

Regarding claims 7/1-7/5 and 16/1-16/5; Milstein et al. teaches all of the limitations of claims 7/1-7/5 and 16/1-16/5 as applied to claims 1-5 above, except for specifically stating that the at least one change is in the respective electromagnetic field pattern of one or more modes of confined light.

Scherer et al. teaches that a mode or set of modes of confined light depends on the defect geometry of a photonic crystal structure (see column 2, lines 9-11). Therefore, one of ordinary skill would have recognized that the mode or set of modes confined by the photonic crystal structure could be controlled by changing the defect geometry of the photonic crystal structure. And Milstein et al. discloses configuring means that change the defect geometry of photonic crystal structures.

Thus, one of ordinary skill in the art would have found it obvious to change the defect geometry of a photonic crystal in the manner disclosed by Milstein et al. to change the electromagnetic field pattern of one or more modes of confined light as desired.

Regarding claims 12/1-12/5; the proposed combination of Milstein et al. and Scherer et al. teaches all of the limitations of claims 12/1-12/5 as applied above to claims 7/1-7/5 and 9/1-9/5.

Claims 18/1-18/5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Milstein et al. (US 5,385,114) in view of Sobiski et al. (US 6,498,886 B1).

Regarding claims 18/1-18/5; Milstein et al. teaches all of the limitations of claims 18/1-18/5 as applied to claims 1-5 above, except for specifically stating that at least one output signal is measured to provide for closed or open loop control (feedback control) of the device. An input signal is inherently applied to the device to change the physical geometry of the device to obtain the desired output in the invention of Milstein et al. regardless of the specific configuring means used (i.e. magnetostrictive components, electrostrictive components, and means for applying force and/or pressure all require an input signal in order to provide dynamic tuning as taught by Milstein et al. in column 13, lines 14-46).

One of ordinary skill in the art would have found it obvious to monitor the output of the device to determine whether or not the desired output was obtained, and to make necessary adjustments to the input signal that is applied to the device to respectively adjust the output of the device, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980). In this instance the control signal or the input signal applied to the configuring means is the result effective variable and the actual output of the device is the end result.

Feedback control loops that measure output optical signals and provide changes to the applied input signals that affect the output signals are conventional in the art. Sobiski et al. discloses a method of adjusting an input signal (108, controller command) to obtain a desired output signal (103, signal out), the method employing a feedback loop created by a detector (105) that measures the output signal (signal out) of the device, wherein the detector (105) sends a control signal (106) to a controller (107) and the controller (107) then adjusts an input signal (controller command, 108) in response to the control signal (105) from the detector (105), thereby creating a feedback control loop.

One of ordinary skill in the art would have found it obvious to use the method disclosed by Sobiski et al. to adjust an input signal to an optical device in order to obtain or maintain a desired value of an output signal, the method including measuring the output signal of the device disclosed by Milstein et al. and adjusting the applied input signal to change the physical geometry of the device, so as to provide for loop control of the device disclosed by Milstein et al.

Allowable Subject Matter

Claim 10 would be allowable if rewritten to overcome the rejection(s) under 35 U.S.C. 112, second paragraph, set forth in this Office action and to include all of the limitations of the base claim and any intervening claims.

Claim 17 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the

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base claim and any intervening claims and if rewritten to overcome the objection to claim 17 set forth above in this Office action.

The following is a statement of reasons for the indication of allowable subject matter: The prior art cited on attached form PTO-892 is the most relevant prior art known, however, the invention of claims 10 and 17 distinguishes over the prior art of record for the following reasons.

Regarding claim 10; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a photonic device as defined in claim 10, wherein the configuring means provides at least one change in the non-linear response in the device, for light propagating therethrough or confined therein in combination with the limitations of the base and/or intervening claims.

Regarding claim 17; the claim is allowable over the prior art of record because none of the references either alone or in combination disclose or render obvious a photonic device as defined in claim 17, wherein the configuring means is adaptive for configuration in part or in whole of the device and includes compensation for imperfections in the photonic crystal structure in part or in whole of the device, and includes compensation for imperfections in part or in whole of the physical geometry of the photonic crystal.

Hence, there is no reason or motivation for one of ordinary skill in the art to use the prior art of record to make the invention of claims 10 and 17.

Conclusion

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Gupta et al. (US 6,274,293 B1) teaches that by changing the dielectric constant or changing the dimension of a photonic crystal structure, the electromagnetic properties can be scaled anywhere from microwave to optical frequencies (see column 1, line 20, through column 3, line 53).

Mattia (US 6,278,105 B1) teaches that PBG devices may be tuned to operate within distinct portions of the spectrum by modifying the physical dimensions of the material forming the device, by modifying the voids, or by applying mechanical pressure on the surface of the material to thereby modify the relative dimensions of the voids and solid portions (see column 2, lines 11-29).

Fan et al. (US 6,512,866 B1) teaches that the geometry and/or dielectric constant/refractive index of a system that includes photonic crystals can be configured to obtain the desired output (see the abstract).

Lourtioz et al. ("Toward Controllable Photonic Crystals for Centimeter- and Millimeter- Wave Devices") teaches that dynamically controlling the spectral and spatial properties of photonic crystals with active elements offers new application prospects; that it has been experimentally shown that the transmission properties of such structures can be radically modified by the presence of dielectric discontinuities and be controlled by their size; and that in addition to electrical elements or light, piezoelectric or thermoelectric elements may also be used to tune the photonic crystals (see the entire paper, especially the conclusion).

Any inquiry concerning the merits of this communication should be directed to Examiner Michelle R. Connelly-Cushwa at telephone number (571) 272-2345. The examiner can normally be reached 9:00 AM to 7:00 PM, Monday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney B. Bovernick can be reached on (571) 272-2344. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Any inquiry of a general or clerical nature should be directed to the Technology Center 2800 receptionist at telephone number (571) 272-1562.

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Michelle R. Connelly-Cushwa

Michelle R. Connelly-Cushwa

Patent Examiner

June 3, 2004